

(19) World Intellectual Property  
Organization  
International Bureau



Rec'd 27 MAY 2005



(43) International Publication Date  
17 June 2004 (17.06.2004)

PCT

(10) International Publication Number  
**WO 2004/050713 A3**

(51) International Patent Classification<sup>7</sup>: **C08F 210/08,**  
4/642

(21) International Application Number:  
PCT/EP2003/012944

(22) International Filing Date:  
14 November 2003 (14.11.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
02080121.3 4 December 2002 (04.12.2002) EP  
60/431,802 9 December 2002 (09.12.2002) US

(71) Applicant (for all designated States except US): **BASELL  
POLYOLEFINE GMBH** [DE/DE]; Brühler Strasse 60,  
50389 Wesseling (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **RESONI, Luigi**

[IT/IT]; Via Arianuova, 56/B, I-44100 Ferrara (IT). **PEL-  
LICONI, Anteo** [IT/IT]; Via Volta, 22, I-45030 Occhio-  
bello (IT). **GARAGNANI, Enea** [IT/IT]; Viale Mons Na-  
tale Mosconi, 75, I-44100 Ferrara (IT).

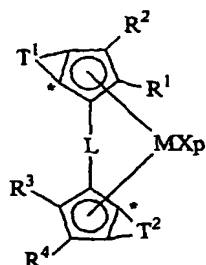
(74) Agent: **COLUCCI, Giuseppe**; Basell Poliolefine Italia  
S.p.A, Intellectual Property, P.le G. Donegani, 12, I-44100  
Ferrara (IT).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,  
SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,  
VC, VN, YU, ZA, ZM, ZW.

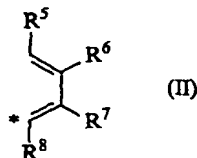
(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,

[Continued on next page]

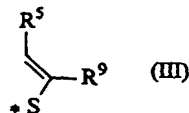
(54) Title: 1-BUTEN COPOLYMERS AND PROCESS FOR PREPARING THEM



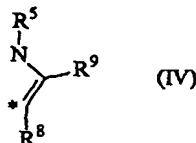
(I)



(II)



(III)



(IV)

(57) Abstract: A process for preparing isotactic 1-butene copolymers containing up to 30% by mol of units derived from one or more alpha olefins of formula  $\text{CH}_2=\text{CHZ}$ , wherein Z is a  $\text{C}_3\text{C}_{20}$  hydrocarbon group comprising contacting 1-butene and one or more of said alphaolefins under polymerization conditions in the presence of a catalyst system obtainable by contacting: (A) a metallocene compound of formula (I) (1) wherein: M is an atom of a transition metal; p is an integer from 0 to 3; X, same or different, are hydrogen atoms, halogen atoms, or an hydrocarbon group; L is a divalent bridging group;  $\text{R}^1$  and  $\text{R}^3$  are hydrocarbon groups;  $\text{R}^2$  and  $\text{R}^4$  are hydrogen atoms or hydrocarbon groups;  $\text{T}^1$  and  $\text{T}^2$ , equal to or different from each other are a moiety of formula (II), (III) or (IV): wherein: the atom marked with the symbol \* is bound the atom marked with the same symbol in formula (I);  $\text{R}^5$ ,  $\text{R}^6$ ,  $\text{R}^7$ ,  $\text{R}^8$  and  $\text{R}^9$ , equal to or different from each other, are hydrogen or hydrocarbon groups; and (B) an alumoxane or a compound able to form an alkylmetallocene cation.

WO 2004/050713 A3



SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**Declaration under Rule 4.17:**

— *of inventorship (Rule 4.17(iv)) for US only*

**(88) Date of publication of the international search report:**

29 July 2004

**Published:**

— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/12944

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 C08F210/08 C08F4/642

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 C08F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 02/100909 A (BASELL POLYOLEFINE GMBH ; RESCONI LUIGI (IT)) 19 December 2002 (2002-12-19) examples 14-19 table 3 claims 1-6,11,12	1-15
P,X	WO 02/100908 A (BASELL POLYOLEFINE GMBH ; RESCONI LUIGI (IT)) 19 December 2002 (2002-12-19) cited in the application examples 10-13 table 3 claims 1-6 catalysts A-1, A-2, A-3, A-5 on page 11 ----- -/--	1-15

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the International filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the International filing date but later than the priority date claimed

\*T\* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

Date of the actual completion of the International search

18 May 2004

Date of mailing of the International search report

14/06/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax (+31-70) 340-3016

Authorized officer

Gamb, V

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/12944

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 03/042258 A (BASELL POLYOLEFINE GMBH ; RESCONI LUIGI (IT)) 22 May 2003 (2003-05-22) examples 3-6 table 1 claims 1-3	1-15
X	SUHM J ET AL: "Influence of metallocene structures on ethene copolymerization with 1-butene and 1-octene" JOURNAL OF MOLECULAR CATALYSIS. A, CHEMICAL, ELSEVIER, AMSTERDAM, NL, vol. 128, 1998, pages 215-227, XP002218351 ISSN: 1381-1169 page 222; examples 10-14; table 3	1-15
X	PATENT ABSTRACTS OF JAPAN vol. 0113, no. 49 (C-456), 14 November 1987 (1987-11-14) & JP 62 119213 A (MITSUI PETROCHEM IND LTD), 30 May 1987 (1987-05-30) abstract	11-15
X	DATABASE WPI Section Ch, Week 198607 Derwent Publications Ltd., London, GB; Class A17, AN 1986-044999 XP002280802 & JP 60 262804 A (MITSUI PETROCHEM IND CO LTD) 26 December 1985 (1985-12-26) abstract	11-15
X	EP 0 353 318 A (NESTE OY ; IDEMITSU PETROCHEMICAL CO (JP)) 7 February 1990 (1990-02-07) table 1 example 4 comparative examples 4,5	11-15

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/12944

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 02100909	A	19-12-2002	WO 02100909 A1	19-12-2002
WO 02100908	A	19-12-2002	WO 02100908 A1	19-12-2002
			EP 1395619 A1	10-03-2004
WO 03042258	A	22-05-2003	WO 03042258 A1	22-05-2003
JP 62119213	A	30-05-1987	JP 1970461 C	18-09-1995
			JP 6104699 B	21-12-1994
JP 60262804	A	26-12-1985	JP 1849211 C	07-06-1994
			JP 5059922 B	01-09-1993
EP 0353318	A	07-02-1990	CA 1319783 C	29-06-1993
			JP 8016133 B	21-02-1996
			JP 63225605 A	20-09-1988
			EP 0353318 A1	07-02-1990
			CA 1309553 C	27-10-1992